What Is Claimed Is:

1. A color processing method used for transforming an arbitrary input color signal to a four-color signal including a black component, the method comprising the step of:

determining K to satisfy a coverage restriction and to maximize a color gamut,

wherein K is an amount of the black component.

2. A color processing method used for transforming an arbitrary input color signal to a four-color signal including a black component, the method comprising the steps of:

determining K corresponding to a representative color signal of the input color signal on a curved plane that satisfies a coverage restriction and uses the color gamut to its maximum; and

determining any K by use of K corresponding to the representative color signal,

wherein K is an amount of the black component.

3. A color processing method used for transforming an arbitrary input color signal in an input color space to a four-color signal including a black component, the method comprising the steps of:

generating a first set of plural optimal K corresponding to plural representative color signals of the input color signal that belong to a partial color space reproducible with three colors and a second set of plural optimal K corresponding to plural representative color signals of the input color signal that belong to a curved plane being reproducible with four colors

including black and satisfying a coverage restriction;

predicting an optimal K corresponding to the input color signal in the input color space based on a model generated from plural pairs of the representative color signals in the input color space and the first or second set of plural optimal K; and

predicting amounts of three colors except black from the predicted optimal K and the input color signal to calculate the four-color signal including the black component,

wherein K is an amount of the black component.

4. The color processing method according to claim 3, wherein the first set of plural optimal K includes a third set of plural optimal K that satisfy the coverage restriction corresponding to plural representative color signals that belong to a periphery of the partial color space.

5. The color processing method according to claim 4, wherein the first set of plural optimal K includes a fourth set of plural optimal K that satisfy the coverage restriction corresponding to additional one or more representative color signals that belong to the partial color space.

6. A color processing method used for transforming an arbitrary input color signal in an input color space to a four-color signal including a black component, the method comprising the steps of:

generating a first set of plural optimal K that satisfy the coverage restriction corresponding to plural representative color signals of the input color signal that belong to a partial color space reproducible with three colors and a second set of plural optimal K corresponding to plural

representative color signals of the input color signal that belong to a curved plane being reproducible with four colors including black and satisfying a coverage restriction;

predicting an optimal K corresponding to the input color signal in the input color space based on a model generated from plural pairs of the representative color signals in the input color space and the first or second set of plural optimal K; and

predicting amounts of three colors except black from the predicted optimal K and the input color signal to calculate the four-color signal including the black component,

wherein K is an amount of the black component.

7. The color processing method according to claim 3, wherein the first set of plural optimal K is calculated by multiplying an achromatic K corresponding to the representative color signal by a K control parameter corresponding to the representative color signal.

8. The color processing method according to claim 4, wherein, in the case where K that is calculated by multiplying an achromatic K corresponding to the representative color signal by a K control parameter corresponding to the representative color signal satisfies the coverage restriction, the calculated K is used as the third set of plural optimal K, and on the other hand, in the case where K that is calculated by multiplying an achromatic K corresponding to the representative color signal by a K control parameter corresponding to the representative color signal does not satisfy the coverage restriction, K that is calculated by searching between the achromatic K corresponding to the representative color signal and K that is

calculated by multiplying an achromatic K corresponding to the representative color signal by the K control parameter corresponding to the representative color signal is used as the third set of plural optimal K.

9. The color processing method according to claim 5, wherein, in the case where K that is calculated by multiplying an achromatic K corresponding to the representative color signal by a K control parameter corresponding to the representative color signal satisfies the coverage restriction, the calculated K is used as the first set of plural optimal K, and on the other hand, in the case where K that is calculated by multiplying an achromatic K corresponding to the representative color signal by a K control parameter corresponding to the representative color signal does not satisfy the coverage restriction, K that is calculated by searching between the achromatic K corresponding to the representative color signal and K that is calculated by multiplying the achromatic K corresponding to the representative color signals by the K control parameter corresponding to the representative color signal is used as the first set of plural optimal K.

10. The color processing method according to claim 7, wherein the K control parameter depends on at least any one of lightness, chroma, and hue calculated from the representative color signal.

11. The color processing method according to claim 3, wherein the curved plane corresponding to the second set of plural optimal K is an outermost periphery surface of the color gamut that is reproducible with four colors including black and satisfies the coverage restriction.

12. The color processing method according to claim 11, wherein representative color signals in the input color space on the outermost periphery surface of the color gamut that is reproducible with four colors including black and satisfies the coverage restriction is calculated by searching on a semi-line that extends in the high chroma direction or the low lightness direction, or the high chroma and low lightness direction from the starting point of the color signal in the input color space inside the color gamut that is reproducible with three colors or on the periphery of the color gamut that is reproducible with three colors.

13. The color processing method according to claim 3, wherein the partial color space is a color gamut that is reproducible with three colors except black.

14. The color processing method according to claim 3, wherein the partial color space is a color gamut that is reproducible with a sum of the all arbitrary combinations of three colors including black.

15. The color processing method according to claim 3, wherein the second set of plural optimal K corresponding to the representative color signals that belong to the curved plane is the maximum K that maximizes K out of one or more four-color signals that reproduce the representative color signals.

16. The color processing method according to claim 15, wherein the maximum K is an achromatic K if the representative color signal is reproducible with the four-color signal including the achromatic K clipped

between 0% and 100%, and on the other hand if the representative color signal is not reproducible with the four-color signal including an achromatic K clipped between 0% and 100%, the maximum K is obtained by calculating a minimum K from the representative color signals and thereafter by searching between the minimum K and 100%.

17. The color processing method according to claim 16, wherein the minimum K is calculated by repeating prediction of the three colors except black, under the condition that one of the three colors is equalized to 100% successively, until both two colors out of the three predicted from the representative color signals have a value equal to 100% or smaller, and thereafter by clipping the predicted K between 0% and 100% when the predicted two colors except black have a value equal to 100% or smaller.

18. The color processing method according to claim 3, wherein the second set of plural optimal K corresponding to the representative color signals that belong to the curved plane is K obtained by clipping an achromatic K corresponding to the representative color signal between 0% and 100%.

19. The color processing method according to claim 7, wherein an achromatic K is calculated by repeating prediction of three colors except black, under the condition that one of the three colors is equalized to 0% successively, until both two colors out of the three predicted from the representative color signals have a non-negative value and thereafter by clipping the predicted K between 0% and 100% when the predicted two colors have a non-negative value.

20. The color processing method according to claim 19, wherein the three colors except black are predicted from the representative color signals under the condition that the one of three colors is equalized to 0 in the order of likeliness of an unwanted color.

21. The color processing method according to claim 3, wherein plural four-color signals are correlated to the input color signals to generate a multi-dimensional look up table (MDLUT), and an arbitrary color signal in the input color space is transformed to the four-color signal by use of the MDLUT.

22. The color processing method according to claim 3, wherein a coefficient that is used for color transformation of an input color image is generated from correlative relation between the input color signals and the four-color signals corresponding to the input color signals, and an arbitrary color signal in the input color space is transformed to a four-color signal by use of the coefficient.

23. A color processing method used for generating a four-color signal including a black component based on an input color signal, the method comprising the steps of:

repeating prediction of amounts of three colors except black, under the condition that one of the three colors is equalized to 0% successively, until both two colors out of the three predicted from representative color signals of the input color signal have a non-negative value;

clipping a predicted K between 0% and 100% when the predicted

two colors have a non-negative value; and

calculating an achromatic K,

wherein K is an amount of the black component.

24. A color processing method used for generating a four-color signal including a black component based on an input color signal, comprising the steps of:

assuming that a maximum K is an achromatic K if representative color signal of the input color signal is reproducible with the four-color signal including the achromatic K clipped between 0% and 100%; and

obtaining the maximum K by calculating a minimum K from the representative color signals and thereafter by searching between the minimum K and 100%, if the representative color signal is not reproducible with the four-color signal including the achromatic K clipped between 0% and 100%,

wherein K is an amount of the black component.

25. The color processing method according to claim 24, wherein the minimum K is calculated by repeating prediction of amounts of three colors except black, under the condition that one of the three colors is equalized to 100% successively, until both two colors out of the three predicted from the representative signals have a value equal to 100% or smaller, and thereafter by clipping a predicted K between 0% and 100% when the predicted two colors have a value equal to 100% or smaller.

26. A computer-readable recording medium that stores a program that makes a computer execute the steps of:

generating a first set of plural optimal K corresponding to plural representative color signals of the input color signal that belong to a partial color space reproducible with three colors and a second set of plural optimal K corresponding to plural representative color signals of the input color signal that belong to a curved plane being reproducible with four colors including black and satisfying a coverage restriction;

predicting an optimal K corresponding to the input color signal in the input color space based on a model generated from plural pairs of the representative color signals in the input color space and the first or second set of plural optimal K; and

predicting amounts of three colors except black from the predicted optimal K and the input color signal to calculate the four-color signal including the black component,

wherein K is an amount of the black component.

27. A recording medium which stores the MDLUT generated by the color processing method according to claim 21.

28. A recording medium which stores the coefficient generated by the color processing method according to claim 22.

29. A color processing apparatus used for generating a four-color signal including a black component from an arbitrary input color signal in an input color space, the apparatus comprising:

an optimal K calculation part that predicts an optimal K corresponding to the color signal in the input color space based on a model generated from plural pairs of a representative color signal of the input color

signal in the input color space and the optimal K corresponding to the representative color signal; and

a four-color signal calculation part that predicts amounts of three colors except black from the optimal K predicted by the optimal K calculation part and the input color signal to thereby calculate a four-color signal including the black component,

wherein the optimal K calculation part uses plural representative color signals that belong to a partial color space that is a color gamut reproducible with three colors and plural representative color signals that belong to the curved plane that is reproducible with four colors including black and satisfies the coverage restriction,

and wherein K is an amount of the black component.

30. The color processing apparatus according to claim 29, wherein the plural pairs used by the optimal K calculation part include plural pairs of the representative color signal that belongs to the periphery of the partial color space and the optimal K that satisfies the coverage restriction corresponding to the representative color signal.

31. The color processing apparatus according to claim 30, wherein the plural pairs used by the optimal K calculation part additionally include one or more pairs of the representative color signal and the optimal K that satisfies the coverage restriction corresponding to the representative color signal.

32. A color processing apparatus used for generating a four-color signal including a black component, from an arbitrary input color signal in a

input color space, the apparatus comprising:

an optimal K calculation part that predicts an optimal K corresponding to the input color signal in the input color space based on a model generated from plural pairs of a representative color signal in the input color space and an optimal K corresponding to the representative color signal; and

a four-color signal calculation part that predicts amounts of three colors except black from the optimal K predicted by the optimal K calculation part and the input color signal to thereby calculate a four-color signal including the black component,

wherein the optimal K calculation part uses plural representative color signals that belong to a partial color space that is a color gamut reproducible with three colors and satisfies the coverage restriction, and plural representative color signals that belong to the curved plane that is reproducible with four colors including black and satisfies the coverage restriction.

33. A color processing apparatus used for generating a four-color signal including a black component from an arbitrary input color signal in a input color space, the apparatus comprising:

a multi-dimensional look up table that stores plural four-color signals obtained by the color processing method according to claim 3 as lattice point data corresponding to the input color signal; and

a color transformation part that generates a four-color signal by use of the multi-dimensional look up table.

34. A color processing apparatus used for generating a four-color

signal including a black component from an arbitrary input color signal in a input color space, the apparatus comprising:

a color transformation part that transforms the input color signal to the four-color signal based on a coefficient obtained in accordance with correlative relation between plural four-color signals obtained by the color processing method according to claim 3.

35. An image marking apparatus used to print an image, comprising:

the color processing apparatus according to claim 29 that transforms the input color signal for the image to a four-color signal including a black component; and

an image marking part that prints the image according to the four-color signal transformed by the color processing apparatus.